### Career and Professional Development

### Non-Credit Programs

### Course Outline

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| **Course Title** | **Computational Applied Statistics** | | |
| **Course Number**  **Continuing Education Units:**  **Instructor(s)** | YCBS 255  4 CEUs  Dr. Vahid Partovi Nia | | |
| **Contact Information** | **Email:** [vahid.partovinia@mcgill.ca](mailto:vahid.partovinia@mcgill.ca) | | |
| **Office hours:** Upon request | | |
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| **Course Description** | This course is designed for adult students with background in introductory probability statistics, and computer programming. The course objective is to equip students with basic statistical machine learning tools. Each lecture is followed with several exercises on data analysis, and computational exercises to complete the lecture.  The assignments must be submitted within a week. Send your questions to [vahid.partovinia@mcgill.ca](mailto:vahid.partovinia@mcgill.ca)  Students must check the online website of the course (MyCourses) regularly for updates and participate in forum, discussions, etc. Evaluation of the course is based on assignments and quizzes. The passing grade for this course is 65% or more. A 75% attendance is required in this course. If your attendance is <75% it will mean an automatic fail. Exercises are individual, more than 50% resemblance of assignment between students is subject to plagiarism, only online submitted \*.pdf assignments are accepted. | | |
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| **Learning Outcomes** | * Use python 3.6 to visualize and execute a predictive model * Install, load, and use conventional libraries related to machine learning and statistical modeling * Combine different algorithms to execute a predictive task * Implement parameter estimation and regularization * Perform model selection and model inference * Improve predictive performance by combining different algorithms * Interpret results of applied statistical methods | | |
| **Course Material** | Required:  The course is built on the famous textbook “Introduction to Statistical Learning with Applications in R” by James, Witten, Hastie, and Tibshirani. This book is adapted for python 3.6 through the lecture materials.    The PDF of the book is freely available from  <http://www-bcf.usc.edu/~gareth/ISL/ISLR%20Fourth%20Printing.pdf>  The printed version can be ordered online from amazon.ca  The datasets of the book are available from  <http://www-bcf.usc.edu/~gareth/ISL/>  Jupyter Notebook of the lectures are available from  <https://github.com/vahidpartovinia/ycbs255> | | |
| **Instructional Methods** | | Teaching and learning approach is experiential, collaborative, and problem-based. | |

**EVALUATION**

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| **Item** | **%** | **Explanation** |
| Active participation | 10 % | * This course consists of a community of learners of which you are an integral member; your active participation is therefore essential to its success. This means: attending class; visiting *myCourses*, doing the assigned readings/exercises before class; and engaging in class discussions/activities. * **A minimum attendance of 75% is required in order to pass the course.** |
| Assignment | 80% | 4 assignments will be given in the following dates on myCourses.   * Assignment 1: 30 October 2018 (20%) * Assignment 2: 13 November2018 (20%) * Assignment 3: 20 November 2018 (20%) * Assignment 4: 4 December 2018 (20%) |
| Quiz | 10% | 4 quizzes, will be given at the beginning of the following classes   * Quiz 1: 30 October 2018 (2.5%) * Quiz 2: 13 November 2018 (2.5%) * Quiz 3: 20 November 2018 (2.5%) * Quiz 4: 4 December 2018 (2.5%) |
| **Total** | **100%** |  |

***In the event of extraordinary circumstances beyond the University’s control, the content***

***and/or evaluation scheme in this course is subject to change.***

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| **UNIVERSITY POLICIES** | |
| ***Academic Integrity***  McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see [*www.mcgill.ca/integrity*](http://www.mcgill.ca/integrity) for more information).  L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site [*www.mcgill.ca/integrity*](http://www.mcgill.ca/integrity/)). | |
| ***Right to submit in English or French***  In accord with McGill University's charter of students' rights, students in this course have the right to submit in English or in French any written work that is to be graded.  In cases where language acquisition is part of the assessment objectives, the work must be submitted in the language evaluated. | |
| ***Email Policy***  E-mail is one of the official means of communication between McGill University and its students. As with all official University communications, it is the student's responsibility to ensure that time-critical e-mail is assessed, read, and acted upon in a timely fashion. If a student chooses to forward University e-mail to another e-mail mailbox, it is that student's responsibility to ensure that the alternate account is viable. Please note that to protect the privacy of students, the University will only reply to students on their McGill e-mail account. | |
| **RESOURCES** |  |
| ***Student Services***  Various services such as Walksafe, McGill Libraries, the Writing Centre, the bookstore, etc., are available to Continuing Education students:  [www.mcgill.ca/continuingstudies/current-students/student-services-and-resources](http://www.mcgill.ca/continuingstudies/current-students/student-services-and-resources) | |
| ***Students with Disabilities***  Students who have a documented disability and require academic accommodations and services should contact the Office of Students with Disabilities (<http://www.mcgill.ca/osd> or 514-398-6009) early in the term. | |
| ***Computer Labs***  Free access to computer labs is available at 688 Sherbrooke (12th floor), MACES, the McLennan Library and other locations on campus. | |
| ***Athena and Online Resources***  Access your personal student information online with Athena (<https://continuingstudies.mcgill.ca/portal/logon.do?method=load>).  Information regarding online resources such as email, VPN, myCourses, etc. can be found at ([www.mcgill.ca/it](http://www.mcgill.ca/it) ). | |
| ***MACES***  The McGill Association of Continuing Education Students, MACES ([www.maces.ca](http://www.maces.ca)), is located at 3437 Peel, 2nd floor, tel. (514) 398-4974. | |

**GRADING SCHEME**

The following grading scheme applies to Non-Credit Transcript Professional Development Certificate programs.

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| **Professional Development Certificates** | | **Grade** |
| Pass | (85-100%) | A |
|  | (80-84%) | A- |
|  | (75-79%) | B+ |
|  | (70-74%) | B |
|  | (65-69%) | B- |
| Failure | (0-64%) | F |
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**A minimum attendance of 75% is required in order to pass the course.COURSE CONTENT**

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| **Class / Day/ Date** | **Topics / Assignments / Readings** |
| **1**  **Tuesday**  **October 23**  **6-9pm** | Session 1: Introduction: python, descriptive statistics, important statistical distributions, random number generation, and basic data visualization. |
| **2**  **Tuesday**  **October 30**  **6-9pm** | Quiz 1.  Session 2: Linear regression: simple linear regression, and multiple linear regression.  Assignment 1. |
| **3**  **Tuesday**  **November 6**  **6pm-9pm** | Session 3: Basic classification: logistic regression, linear discriminant, and quadratic discriminant. |
| **4**  **Tuesday**  **November 13**  **6-9pm** | Quiz 2.  Session 4: Error estimation: cross-validation, and bias-variance trade-off.  Assignment 2. |
| **5**  **Saturday**  **November 17**  **9am-4pm** | Session 5: Shrinkage methods: subset selection, ridge shrinkage, and lasso shrinkage.  Session 6: Dimension reduction: principal components, and partial least squares. |
| **6**  **Tuesday**  **November 20**  **6pm-9pm** | Quiz 3.  Session 7: Beyond linearity: smoothing splines, local regression, and additive models.  Assignment 3. |
| **7**  **Tuesday**  **November 27**  **6-9pm** | Session 8: Tree and ensemble methods: regression trees, classification trees, bagging, and boosting. |
| **8**  **Tuesday**  **December 4**  **6pm-9pm** | Quiz 4.  Session 9: Powerful classifiers: support vector machines, and random forest.  Assignment 4. |
| **9**  **Tuesday**  **December 11**  **6pm-9pm** | Session 10: Unsupervised learning: k-means, and hierarchical clustering. |